

AMENDMENTS TO THE CLAIMS

1 – 18 Cancelled

19. (new) An apparatus for denoising an input noisy signal, the apparatus comprising:

one or more memories; and

a controller that

receives the noisy signal z that includes a number of sequentially ordered symbols, each symbol having a position,

stores the noisy signal z in the one or more memories,

receives a signal r , output from a preliminary denoising system that operates on the received noisy signal z , that includes a number of sequentially ordered symbols, each symbol having a position,

stores the signal r in the one or more memories, and

produces an output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation.

20. (new) The apparatus of claim 19 wherein the controller produces the output signal z' by:

for each of a number of different symbol subsequences, $z(q)$, about symbol z_q , that occur in the received noisy signal z ,

counting a number of occurrences of each symbol at the corresponding positions p in signal r , r_p , for positions p in the received noisy signal z at which $z(p)$ is equal to $z(q)$ and storing the counted number of occurrences in the one or more memories; and

for each of the number of symbol subsequences, $z(q)$, in the received noisy signal z ,

replacing symbol z_q of subsequence $z(q)$ in all occurrences of subsequence

$z(q)$, at positions z_p , in the noisy signal z with a replacement symbol z'_q which produces a minimal computed signal degradation.

21. (new) The apparatus of claim 20 wherein the one or more memories store:

a degradation function $C()$ that ;

the received noisy signal z ;

the signal r ; and

the counts of the number of occurrences of each symbol at the corresponding positions p in signal r , r_p , for positions p in the received noisy signal z at which $z(p)$ is equal to $z(q)$.

22. (new) The apparatus of claim 21 wherein the replacement symbol z'_q for symbol z_q of subsequence $z(q)$ is computed as a symbol that is computed to produce a least estimated signal degradation, using the degradation function $C()$, when z'_q is substituted for z_q in each occurrence of subsequence $z(q)$ in noisy signal z .

23. (new) The apparatus of claim 22 wherein the estimated signal degradation produced by replacing symbol z_q of each occurrence of subsequence $z(q)$ with symbol z'_q is computed as:

$$\text{degradation} = \sum_p C(r_p, z'_q)$$

where $C(r_p, z'_q)$ is the degradation estimated for replacing the symbol r_p at position p in the signal r with symbol z'_q ; and

p represents the positions in the signals r and z at which $z(p)$ is equal to $z(q)$.

24. (new) The apparatus of claim 19 wherein a subsequence $z(q)$ is a number of symbols that precede, follow, or both precede and follow a symbol z_q at position q in noisy sequence z .

25. (new) The apparatus of claim 24 in which the number of symbols in a subsequence is determined by the controller to be sufficiently small to ensure that the number of occurrences of each subsequence is sufficiently large to provide a desired statistical significance to signal degradation estimation and sufficiently large to ensure that an adequate number of subsequence correlations contribute to denoising.

26. (new) A method for denoising a noisy signal and partially corrected signal to generate an output signal, the method comprising:

receiving the noisy signal z that includes a number of sequentially ordered symbols, each symbol having a position,

storing the noisy signal z in one or more memories,

receiving the partially corrected signal r , output from a preliminary denoising system that operates on the received noisy signal z , that includes a number of sequentially ordered symbols, each symbol having a position,

storing the partially corrected signal r in the one or more memories, and

producing the output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation.

27. (new) The method of claim 26 wherein the output signal z' is produced by:

for each of a number of different symbol subsequences, $z(q)$, about symbol z_q , that occur in the received noisy signal z ,

counting a number of occurrences of each symbol at the corresponding positions p in signal r , r_p , for positions p in the received noisy signal z at which $z(p)$ is equal to $z(q)$ and storing the counted number of occurrences in the one or more memories; and

for each of the number of symbol subsequences, $z(q)$, in the received noisy signal z ,

replacing symbol z_q of subsequence $z(q)$ in all occurrences of subsequence

$z(q)$, z_p , in the noisy signal z with a replacement symbol z'_q which produces a minimal computed signal degradation.

28. (new) The method of claim 27 further comprising computing the replacement symbol z'_q for symbol z_q of subsequence $z(q)$ as a symbol that produces a least estimated signal degradation, using the degradation function $C()$, when z'_q is substituted for z_q in each occurrence of subsequence $z(q)$ in noisy signal z .

29. (new) The method of claim 28 further comprising computing the estimated signal degradation produced by replacing symbol z_q of each occurrence of subsequence $z(q)$ with symbol z'_q as:

$$\text{degradation} = \sum_p C(r_p, z'_q)$$

where $C(r_p, z'_q)$ is the degradation estimated for replacing the symbol r_p at position p in the signal r with symbol z'_q ; and

p represents the positions in the signals r and z at which $z(p)$ is equal to $z(q)$.

30. (new) The method of claim 26 wherein a subsequence $z(q)$ is a number of symbols that precede, follow, or both precede and follow a symbol z_q at position q in noisy sequence z , the subsequence including symbol z_q .

31. (new) The method of claim 26 further comprising determining the number of symbols in a subsequence by selecting the number of symbols in a subsequence to be sufficiently small to ensure that the number of occurrences of each subsequence is sufficiently large to provide a desired statistical significance to signal degradation estimation and to be sufficiently large to ensure that an adequate number of subsequence correlations contribute to signal denoising.

32. (new) A computer readable medium encoded with a data processing program for

denoising a noisy signal and a partially corrected signal to generate an output signal by:

receiving the noisy signal z that includes a number of sequentially ordered symbols, each symbol having a position,

storing the noisy signal z in one or more memories,

receiving the partially corrected signal r , output from a preliminary denoising system that operates on the received noisy signal z , that includes a number of sequentially ordered symbols, each symbol having a position,

storing the partially corrected signal r in the one or more memories, and

producing the output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation.